

WATERSHED REVIEW

HENKEL CREEK WATERSHED

Draft March 16, 2012

Ministry Contract No: CS12NRH-012

BIOPHYSICAL AND LAND-USE CHARACTERISTICS OF THE WATERSHED

Table 1. Summary Information – Watershed Characteristics – (see Figures 1 and 2)

Size (km ²)	Dominant BEC Zones	Dominant NDT	Elevation Range (m)	Surficial Geology near the Mouth (i.e. sensitive area)	Stream Density (km/km ²)	Biggest % of watershed in same elevation band ¹	Distribution of slope gradients within the watershed (% of watershed)			
							<10% slope	10 to 30% slope	30 to 60% slope	>60% slope
38.1	SBS	NDT3	730-1378	Medium textured till	1.40	55.1	68.4	29.8	1.79	0.01

¹ The entire watershed is divided into 300 m elevation bands. The less elevation bands there are and the more area is represented by any given single elevation band, then the greater will likely be the effect of forest harvesting on increased peak flows due to the theoretical concept of “synchronization” (i.e. the melt from the cutblocks is synchronized as much of it comes from the same elevation), and the greater sensitivity it will have.

Table 2. Rating of “Sensitivity” of Watershed to Increased Peak Flow at the lower reaches

Rosgen Stream Channel Type	Rosgen Stream Channel Sensitivity Score	Sensitivity score relative to topography	Sensitivity score relative to lateral connectivity	Sensitivity score relative to vertical conductivity	Sensitivity score relative to climate	Sensitivity score relative to flow synchronization potential	Sensitivity score relative to NDT type	Sensitivity Score	Sensitivity Rating
C4- Mod unstable/disturbed	4.5	0.8	1.1	0.95	1.1	1.10	1	4.53	High

Table 3. Rating of “Sensitivity” of Watershed to Increased Production of Fine Sediment at lower reaches

Stream Channel Type	Reach Sensitivity Score	Sensitivity score relative to topography	Sensitivity score relative to lateral connectivity	Sensitivity score relative to drainage density	Sensitivity score relative to climate	Sensitivity score relative to soils	Sensitivity Score	Sensitivity Rating
Riffle-pool gravel	5	0.75	1.2	1	1.1	1	5.0	Very High

Table 4. Rating of “Sensitivity” of Watershed to a Loss In riparian Function.

Stream Channel Type	Reach Sensitivity Score	Sensitivity score relative to Aspect	Sensitivity score relative to climate	Overall watershed sensitivity to loss of riparian	Loss of Riparian Sensitivity Rating
C3-C6	4.82	1.1	1.1	5.83	Very High

Table 5. Peak Flow Hazard Rating, as indexed by HEDA – current scenario (i.e. no proposed harvesting considered)

Watershed area (km ²)	Total area Pine Leading (km ²)	Total area Pine Mixed (km ²)	Total area harvest (km ²) ¹	Total HEDA from Pine Beetle alone (%)	Total HEDA from logging alone (%)	Total HEDA from logging and Pine Beetle mortality (%)
38.1	10.0	8.99	4.97	20.14	9.89	30.03

¹Note: This includes openings from VRI database, and non-overlapping openings from RESULTS and FTEN databases.

Table 5 (continued)

Total area in Agriculture (km ²)	Total area in Agriculture (% of watershed)	Total area in Proposed Harvest (km ²)	Total HEDA (%)	HEDA Hazard rating Score	HEDA Hazard Rating
0.26	0.68	0.00	30.71	2.75	Mod

Table 6. Fine Sediment Hazard Rating, as indexed by the Stream Crossing Density

Watershed area (km ²)	# of x-ings	#of fish bearing X-ings ¹	#of non-fish bearing X-ings	density of x-ings (#/km ²)	Density of fish bearing X-ings (#/km ²)	Density of non-fish bearing X-ings (#/km ²)	Hazard Rating Score	Hazard Rating
38.1	17	17	0	0.4	0.4	0.00	2.48	Low

¹Note: The information on stream crossings was provided by MoE and was generated with a GIS model, not fieldwork.

Table 7. Loss of Riparian Function Hazard Rating (See Figures 4 to 9)

Reach Number	Rosgen Stream Type	Reach Length (m)	% riparian logged (as interpreted from air photos)	Apparent stability and other comments (as viewed from air photos)
1	C4 - Sig Unstable/disturbed	213	31.5	Quite Unstable
2	C4 - Sig Unstable/disturbed	965	82.9	Quite Unstable
3	C4- Mod unstable/disturbed	646	100.0	Moderately De-stabilized
4	C4- Mod unstable/disturbed	3464	35.0	Lightly De-stabilized
5	B4-Stable	1183	0.0	Stable
6	B4-Stable	3036	0.0	Stable
7	B4-Stable	2203	0.0	Stable
Hazard Scores:			Hazard Rating Score	Hazard Rating
			3.25	Mod

Table 8. Risk Rankings for the Different Hazards in the watershed current scenario (i.e. no proposed harvesting considered)

Watershed Hazard Types	Sensitivity Score	Sensitivity Rating	Hazard Score	Hazard Rating	Risk Score	Risk Rating
Increased Peak Flow	4.53	High	2.75	Mod	12.5	Mod
Increase in Production of Fine Sediment	4.95	Very High	2.48	Low	12.3	Mod
Loss of Riparian function	5.83	Very High	3.25	Mod	19.0	High

Table 9. Summary Table for Fish Values^{1,2}

Watershed Name	Size (km ²)	FID	Species	Productivity	Diversity	Significant Species	Ranking ³	Comments
Henkel Creek	38.1	36	RB, DV			x	H	

¹ Note: The “Fish Values” were assessed and provided by Fisheries Biologists from the Ministry of Forest, Lands, and Natural Resource Operations. Fisheries value score (High, Very High, or Extreme) is based on the occurrence of (1) exceptional fisheries productivity, or (2) high fish species diversity (more than three species), or (3) notable significance of fish species (i.e. listed species, stock at risk, large piscivorous rainbows), or (4) a combination of 1, 2, and/or 3. If none of these characteristics occurred in the watershed it was not considered for FSW status

² Note: This table was extracted from Tables 26 and 27 provided in Appendix 1 of the methodology document.

³ Ranking System:

- 3x = Extreme (E)
- 2x = Very High (VH)
- 1x = High (H)
- 0x = No rating

Table 10. Fisheries Sensitive Watershed Score and Rating

Name	Size (km ²)	Peak Flow Sensitivity	Sed Sensitivity Rating	Riparian Sensitivity	Fish Value ¹	FSW Score PF vs Fish	FSW Score Seds vs Fish	FSW Score Rip vs Fish	Overall FSW Score	Overall FSW Rating
Henkel Creek	38.1	High	Very High	Very High	High	3	4	4	11	High

¹ Note: The fish value class is obtained from Table 9 above.

INTERPRETATIONS AND RECOMMENDATIONS FOR MANAGEMENT STRATEGIES FOR PROTECTION OF WATER RESOURCES IN THIS WATERSHED

Brief Watershed Description (Table 1 and Figures 1 and 2)

Henkel Creek watershed has a south facing aspect and flows directly into the north side of Francois Lake. The watershed is dominated by flat to rolling topography with the elevations ranging between 730 and 1378 m. The watershed is almost entirely distributed over two 300m elevation bands with the majority of the watershed (55%) being in the elevation band between 1031 and 1331m and 42% is in the elevation band between 731 and 1031. Ninety eight percent of the watershed has slopes less than 30% and the dominant biogeoclimatic zone in this watershed is the SBSdk.

The upper mainstem reaches of Henkel Creek are low gradient, relatively unconfined and stable channels classified as Rosgen B4 type channels (reaches 5, 6 and 7). Reach 4 has a bit of a steeper gradient as it flows down through a narrow entrenched valley with a small floodplain. There is evidence of channel disturbance and accelerated channel erosion in the lower part of this reach. Reach #3 flows out onto an unconfined floodplain which appears to have been extensively disturbed and shows extensive signs of instability and accelerated bank erosion. Reaches #2 and 1 are low gradient, meandering channels that flow across an active and highly disturbed fan and show extensive signs of instability and accelerated bank erosion (figure 5 and 6). This instability increases the sensitivity of the lower reaches, which were already sensitive types to begin with.

The surficial geology of this watershed is dominated by a mixture of fine and moderately coarse textured tills with some coarser textured fluvial and glacio-fluvial sections in the lower watershed (Figure 1 and 2). There appears to have been extensive riparian disturbances in the lower 4 reaches of this watershed. The upper reaches appear to have been well protected from riparian harvesting

Sensitivities, Hazards and Risks in this Watershed

The overall sensitivity of the watershed to increases in peak flows has been classified as a high (Table 2). This is mostly due to the high sensitivity of the lower reaches and the disturbances that have occurred along them. The sensitivities to increases in the production of fine sediments and a loss of riparian function have been classified as very high. The current risk ratings are moderate for peak flows, moderate for fine sediments and high for riparian (Table 8).

When considering both the overall physical sensitivities in this watershed and the fisheries values, the Fisheries Sensitive Watershed (FSW) rating is assessed as high (Tables 9 and 10).

Suggested Management Objectives and Strategic Directions for this Watershed

- 1) Given that the overall sensitivity of this watershed to increases in peak flows has been assessed as a high, I suggest that this is an important hazard to manage for this watershed. If this watershed is designated as a fisheries sensitive watershed, then I suggest that peak flow risk should be maintained at a low level, or less. Since the risk is already at a moderate level, this means that no further forest harvesting could occur in this watershed for several years until adequate hydrological recovery has occurred. The current HEDA

value is 30.7% and I suggest that this should be lowered to below 20% before further harvesting could be initiated in this watershed, if this watershed was designated as fisheries sensitive.

- 2) The sensitivity to increases in sediment is rated as a very high and the current risk is a moderate. Given these high ratings, it is important that appropriate management of erosion and sediment transport be given a high priority in this watershed. If this watershed is designated as fisheries sensitive then minimizing erosion and the delivery of fine sediments at all stream crossings should be a priority along with the monitoring of this. I recommend that the Water Quality Effectiveness Evaluation (WQEE) tool be used and that the WQEE rating be maintained below a moderate level for all crossing in this watershed (i.e. Low or Very Low). The most recent WQEE protocol can be found at the following web link:
<http://www.for.gov.bc.ca/ftp/hfp/external/!publish/frep/indicators/Indicators-WaterQuality-Protocol-2009.pdf>
- 3) The sensitivity of this watershed to a loss in riparian function has been classed as a very high and the current risk rating is high. Consequently, extra riparian protection measures should be implemented in this watershed if it is designated as fisheries sensitive. These could include increased protection of smaller streams in the watershed. I suggest that for all S4 streams wider than 0.5 m to maintain long term large woody debris (LWD) recruitment to the stream channel by retaining at least 90% of the riparian area in a state undisturbed by primary forest activities. Note that the riparian area refers to the management area measured from the closest streambank to a distance 15m upslope from the streambank.

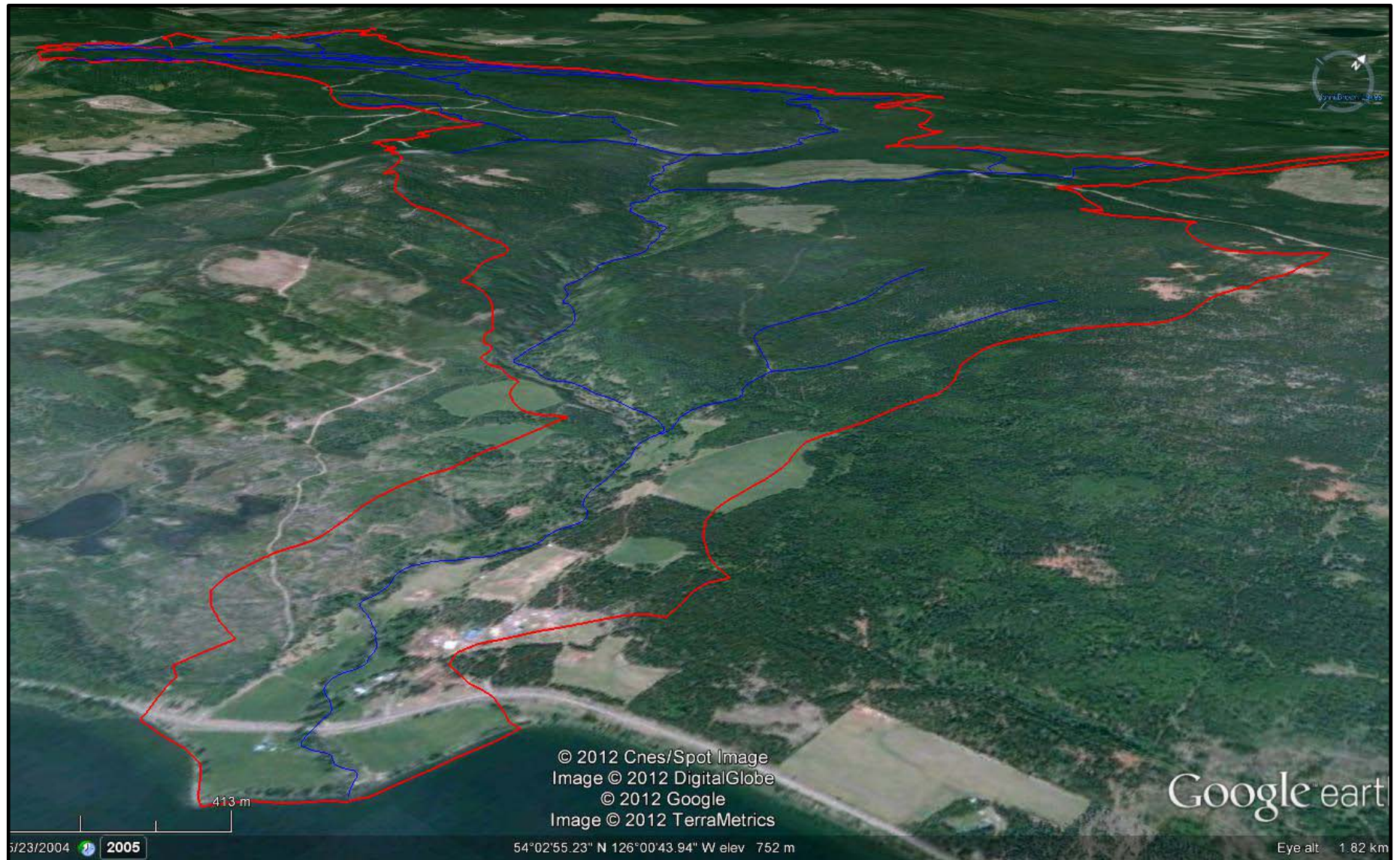


Figure 1. Google earth overview image of Henkel Creek watershed, looking upstream into the watershed.

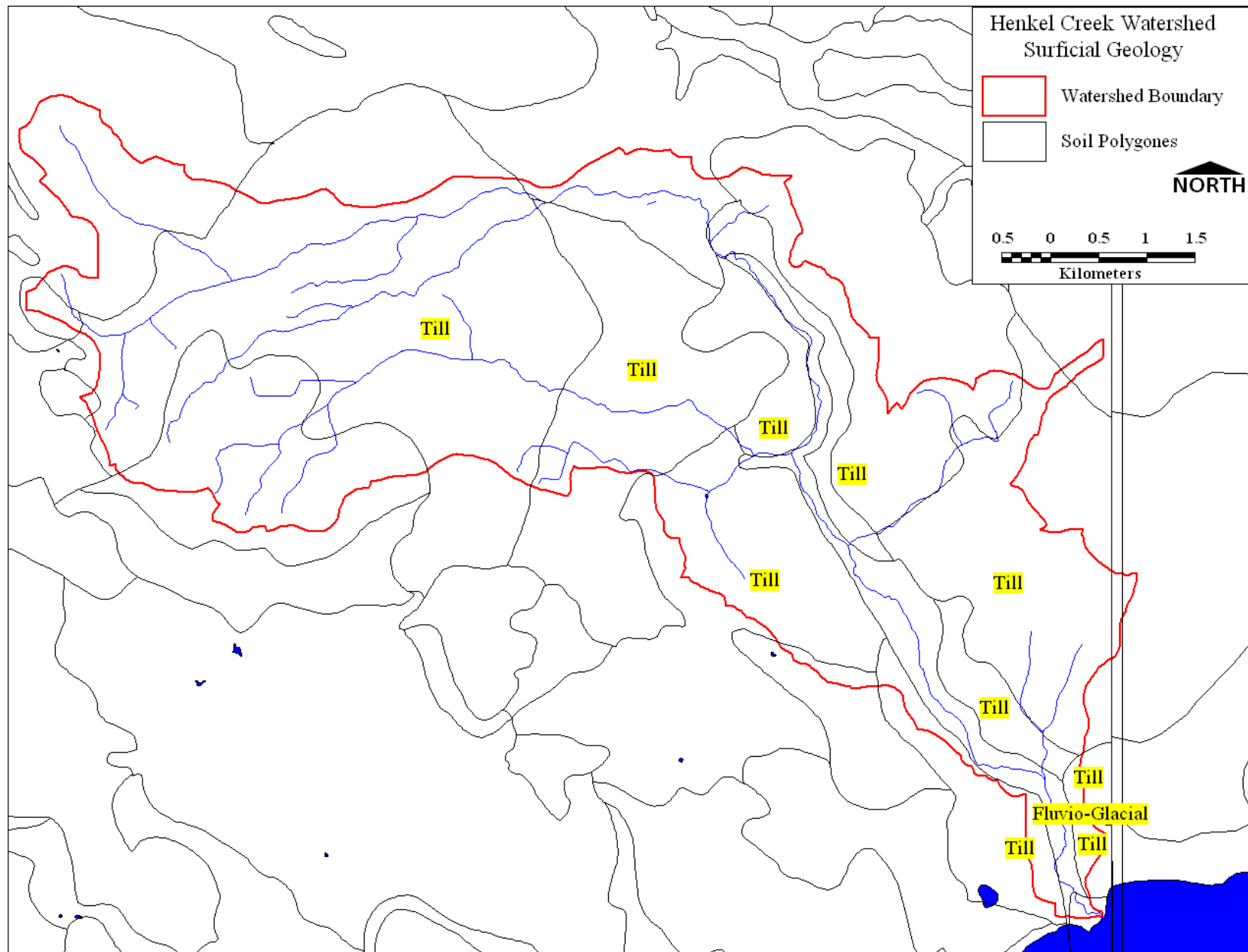


Figure 2. Distribution of surficial geology types near the mouth of Henkel Creek watershed.

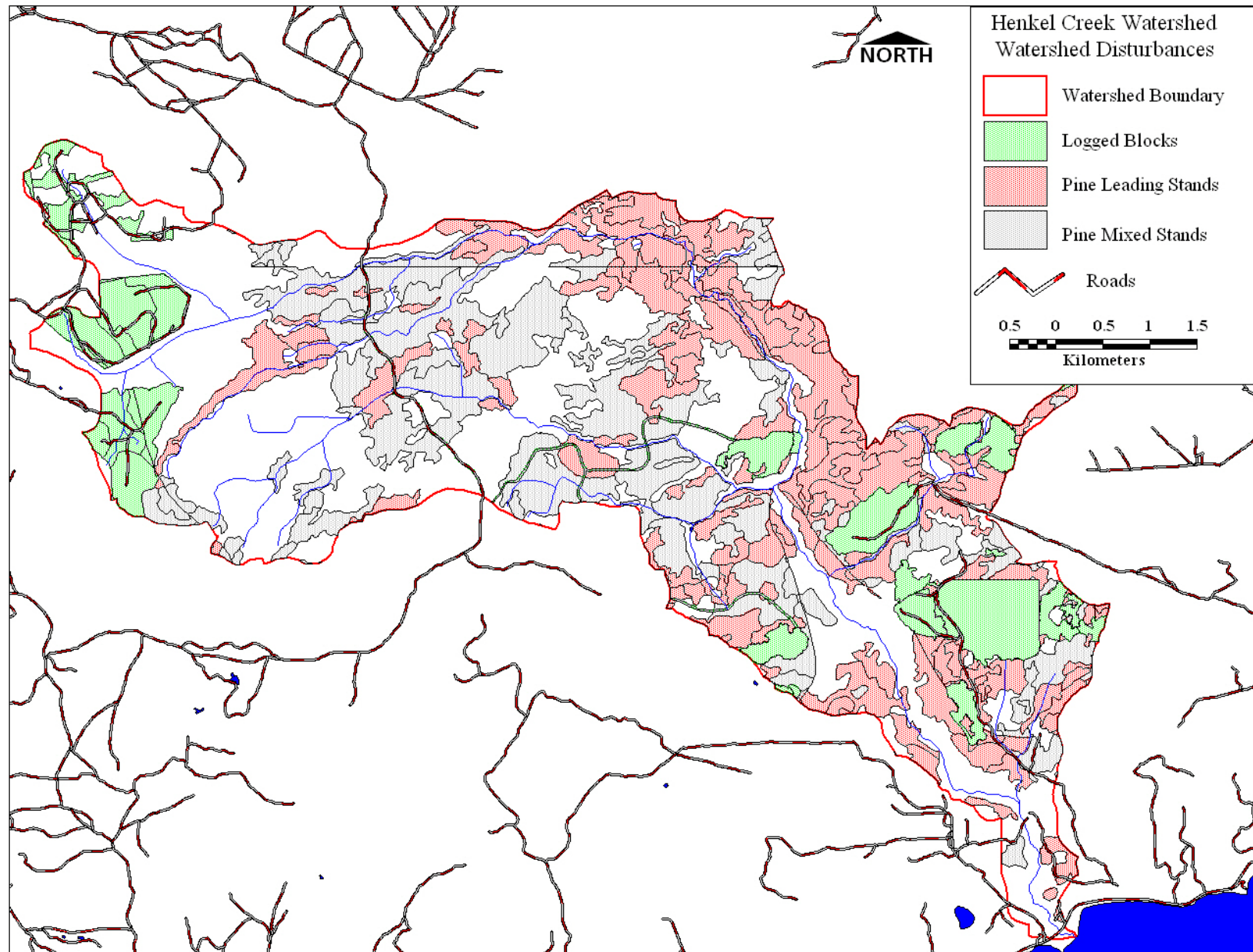


Figure 3. Land-use related and large natural disturbances in the Henkel Creek Watershed

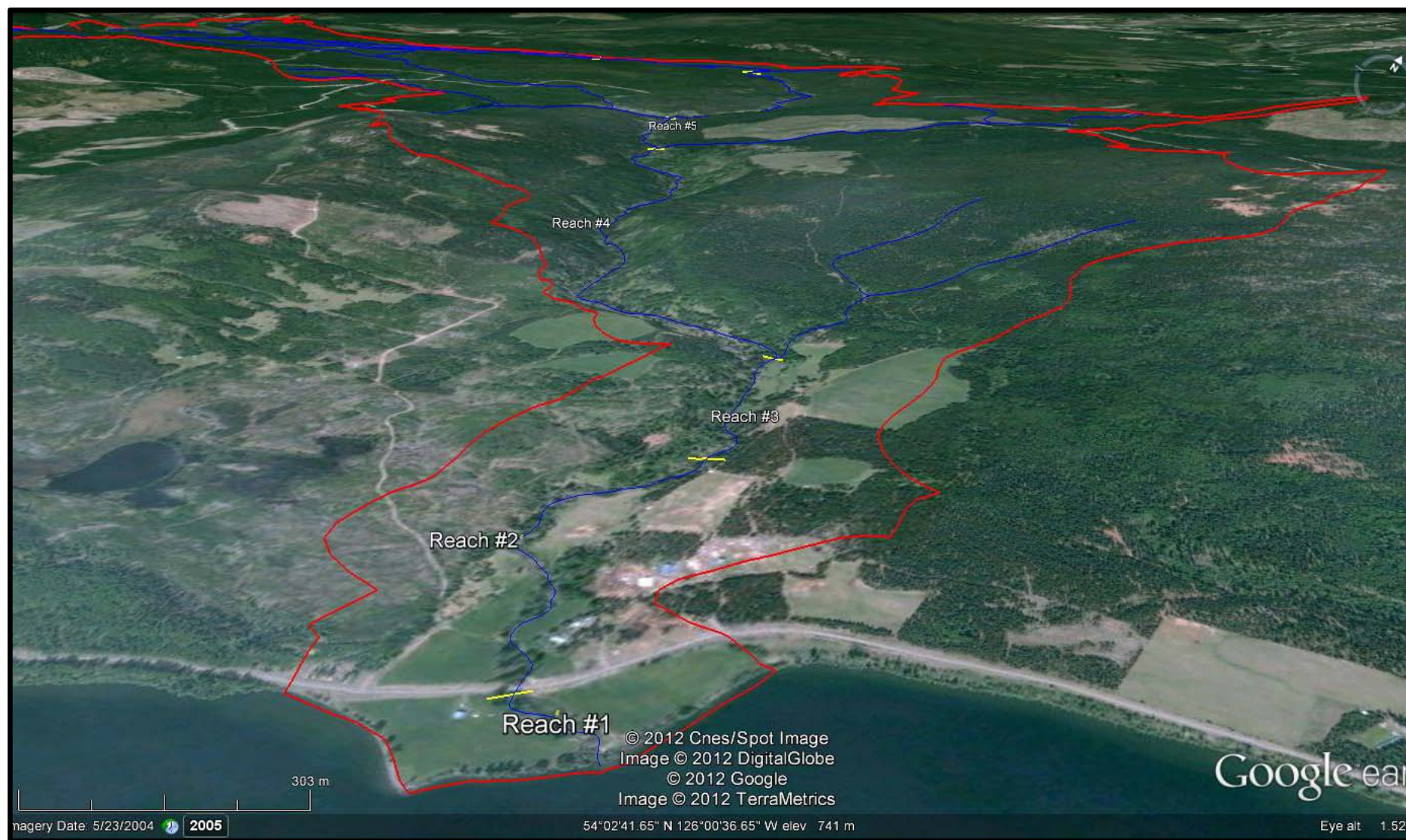


Figure 4. Identification of reaches along the mainstem of Henkel Creek watershed



Figure 5. Google Earth image looking upstream along Reach #1 of Henkel Creek.

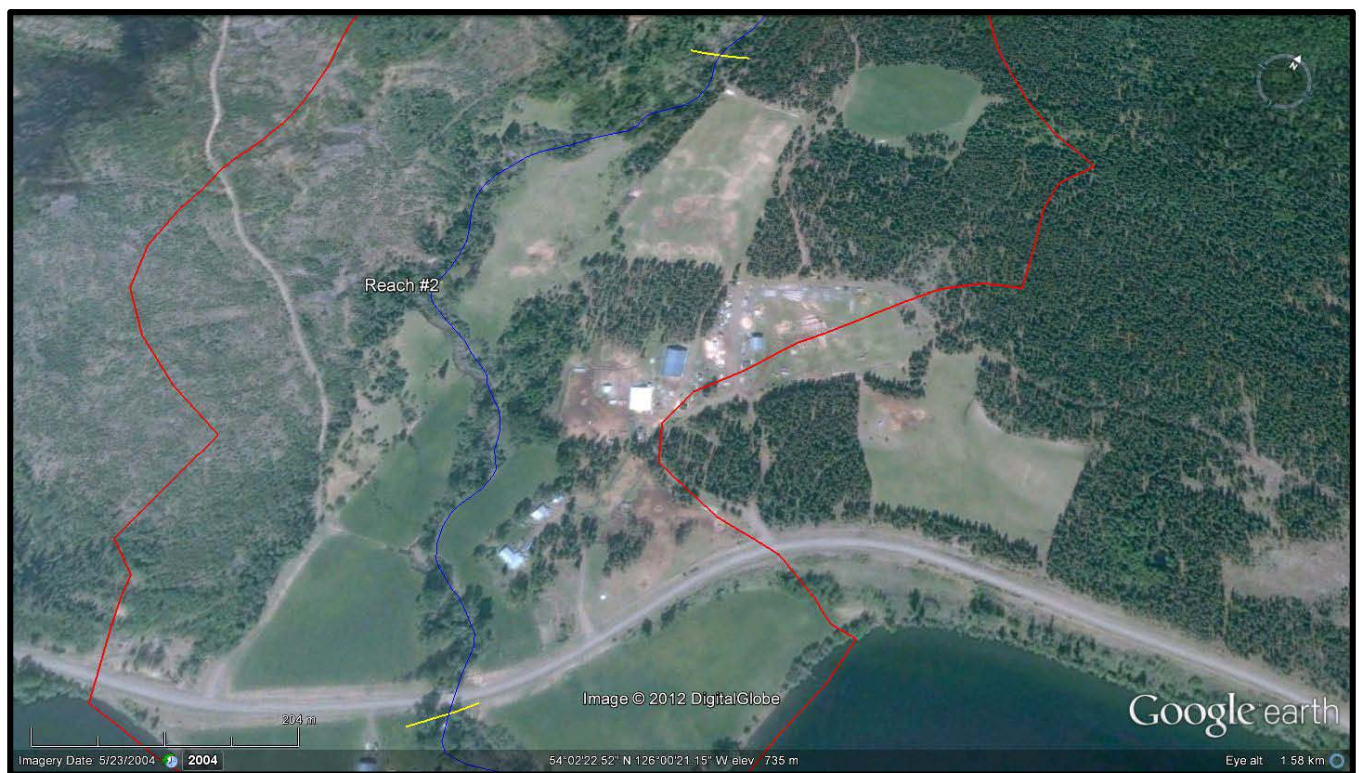


Figure 6. Google Earth image looking upstream along Reach #2 of Henkel Creek.



Figure 7. Google Earth image looking upstream along Reach #3 of Henkel Creek.

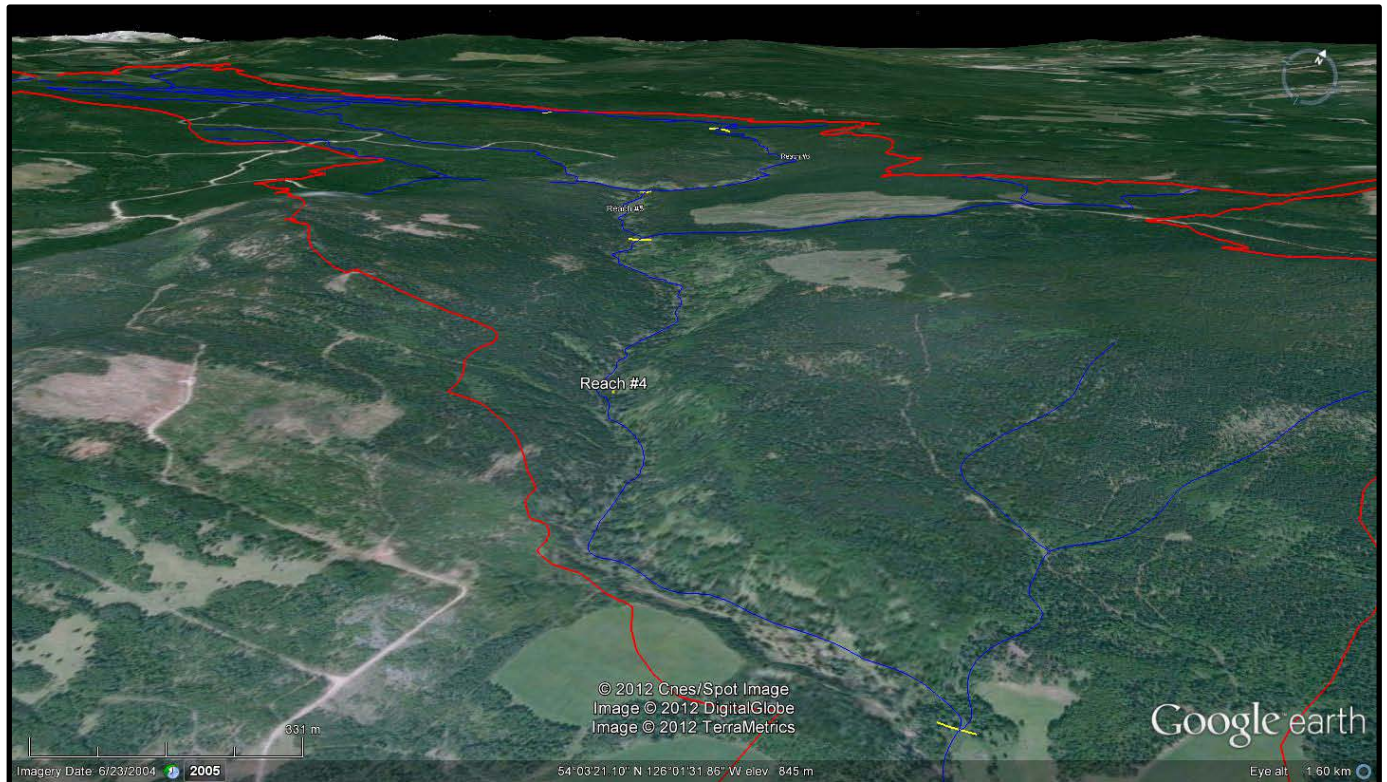


Figure 8. Google Earth image looking upstream along Reach #4 of Henkel Creek.

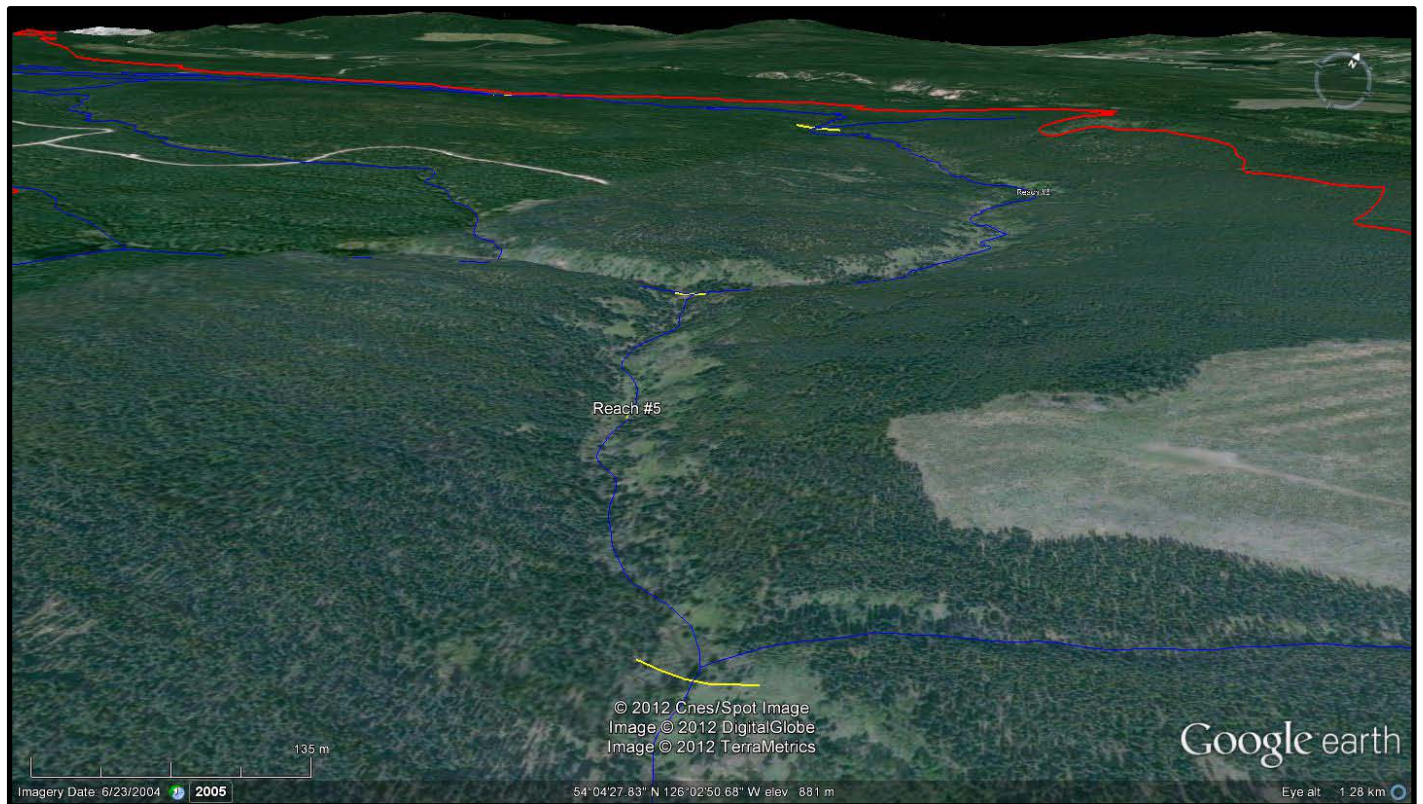


Figure 9. Google Earth image looking upstream along Reach #5 of Henkel Creek.



Figure 10. Google Earth image looking upstream along Reach #6 of Henkel Creek.



Figure 11. Google Earth image looking upstream along Reach #7 of Henkel Creek.